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THE FORESTS OF THE UNITED STATES: THEIR USE.

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THE FORESTS OF THE UNITED STATES: THEIR USE.

WHAT FORESTS DO.

Our industries which subsist wholly or mainly upon wood pay the wages of more than 1,500,000 men and women.

Forests not only grow timber, but they hold the soil and they conserve the streams. They abate the wind and give protection from excessive heat or cold. Woodlands make for the fiber, health, and happiness of each citizen and of the nation.

The fish which live in forest waters furnish each year $21,000,000 worth of food, and not less than half as much is furnished by the game which could not exist without the forest.

The industries which use wood wholly or mainly in manufacture represent an investment of over $2,250,000,000 and yield each year a product worth nearly $3,000,000,000.

Forests conserve streams by regulating their flow. Our knowledge of the effect of forests upon the quantity of water carried by streams is not yet complete. Our knowledge of the effect of forests upon the regularity of stream flow has an adequate basis of observation and record.

We do not possess complete scientific proof that forests increase rain, but known laws governing rainfall and the known physical effects of forests lead straight to that conclusion. A part of the falling rain or snow is checked by the tree tops and returned to the air by evaporation. But this evaporation is wholly or nearly compensated for by the smaller evaporation from the soil under forest cover than from the soil in the open. The forest soil gives up water to the air more slowly than either brush land, meadow land, or cultivated fields.

Both observation and record show fully that forests powerfully affect the manner in which water reaches streams and passes down them. The forest floor is a blanket, and like a blanket it will hold

more water than will the harder and relatively less porous soil of the open. A forest soil when saturated will hold more than half its dry weight in water, or over 6 inches of water for every foot of soil. This, as well as the breaking up of forest soil by the roots of trees and undergrowth, makes it more effective than any other cover for the intake of water into that vast underground reservoir from which all streams and springs are fed.

When the forest is cleared from a mountain watershed the blanket formed by the decaying leaves, branches, and fallen trees is burned up, dried by the sun, or carried off by wind and water. This is inevitably followed by increase in the frequency and duration of floods. This fact is known to every man who has had an opportunity to observe it. To those who have not had this opportunity the story is told by actual record of stream flow upon rivers for a period during which the mountain forests on their watersheds were rapidly denuded. These are such as the Ohio, Monongahela, Allegheny, Cumberland, Alabama, Savannah, Wateree, Congaree, and Muskingum.

That surface conditions affect stream flow is shown by the record of streams whose naturally treeless watersheds by cultivation have been made more retentive of water. The principal watershed of the Red River lies in the prairie country of western Texas and Oklahoma. With slightly decreased rainfall this stream shows during the last sixteen years a marked decrease in the frequency and duration of floods and of low water. During this period much of its watershed has been cultivated, groves have been planted, and fires checked, resulting in a larger capacity for the absorption and storage of water.

That forests hold soil and that hillsides denuded of forest do not hold their soil is to be seen in any mountain region in the United States. One small stream has been found by actual measurement to deposit silt in one year equal to $1\frac{1}{2}$ tons per acre of its watershed. For the whole United States the loss of soil each year is from one to two thousand million tons. At the lowest estimate the total quantity of silt carried by our streams would cover 1 foot deep a surface of more than 900 square miles. The larger part of it is deposited in the lower courses of our streams and in our harbors, a menace to navigation and to present developed water powers, and a handicap to their development.

The National Forests in the Rocky Mountain and Pacific coast States afford summer ranges to over 12 per cent of the cattle and 21 per cent of the sheep in the States in which they lie. If this live stock were not fed in the forests during the summer months it would be without natural forage during the winter. For the East, the num-

ber of forest-fed live stock can not be given. But notably in the southern pine belt and in the southern mountains, live-stock owners, especially small holders, turn out their sheep, cattle, and hogs in the forests for the larger part of each year.

That the existence of nearly all kinds of wild game depends directly upon the conservation of the forest is well known. The deer killed in six States alone in the Northeast represents each year a food value of over $1,000,000. The raw furs exported yearly from the United States are worth $7,000,000 to $8,000,000, and raw furs worth in the aggregate still more are kept for manufacture here. Most of these furs are taken from forest animals. Relatively few kinds of fresh-water fish, and mainly those of inferior food value, will endure in streams fed from denuded watersheds.

WHAT WE HAVE.

Our forests now cover 550,000,000 acres, or about one-fourth of the United States. The original forests covered not less than 850,000,000 acres.

Forests publicly owned contain one-fifth of all timber standing. Forests privately owned contain at least four-fifths of the standing timber. The timber privately owned is not only four times that publicly owned, but it is generally more valuable.

Forestry is now practiced on 70 per cent of the forests publicly owned and on less than 1 per cent of the forests privately owned, or on only 18 per cent of the total area of forests.

The orginal forests of the United States contained timber in quantity and variety far beyond that upon any other area of similar size in the world. They covered 850,000,000 acres, with a stand of not less than 5,200,000,000,000 board feet of merchantable timber, according to present standards of use. There were five great forest regions—the northern, the southern, the central, the Rocky Mountain, and the Pacific.

The northern forest was the home of the white pine. With it grew red pine, spruce, hemlock, cedar, balsam fir, and several hardwoods. Before clearing and logging began, the northern forest probably covered 150,000,000 acres, and contained not less than 1,000,000,000,000 board feet. In the southern forest the yellow pines were the most common trees, with hardwoods on the better soils and cypress in the swamps. The southern forest probably covered 220,000,000 acres and contained at least 1,000,000,000,000 board feet. The central forest was nearly all hardwoods, among which the more important were oak, yellow poplar, elm, hickory, chestnut, red gum, ash, and walnut. Its area was about 280,000,000 acres and its stand 1,400,000,000,000 board feet. The Rocky Mountain forest was coniferous and grew mainly upon the mountains. Western yellow pine was the most common tree, with lodgepole pine, larch, spruce, western red cedar, west-

ern white pine, and Douglas and other firs abounding locally. The Rocky Mountain forest covered about 110,000,000 acres, with a stand of 400,000,000,000 board feet. The Pacific forest was nearly all evergreen, chiefly Douglas fir, western yellow pine, redwood, western red cedar, sugar pine, and several other firs, cedars, and spruces. Its trees were the largest and its stands the heaviest recorded by history or by geology. The Pacific forest probably contained 90,000,000 acres, with a stand of 1,400,000,000,000 feet.

As well as these great forest regions, the United States probably contained 100,000,000 acres, chiefly in the West, of scrubby forests and brush land, of great value in conserving stream flow and for fuel, posts, and other small material.

Our present forests, except upon the Pacific coast and in the Rocky Mountains, are all that remain of those which once covered 45 per cent of the country. Clearing for agriculture, logging, and fire have reduced this to 29 per cent, or 550,000,000 acres, with a probable stand of 2,500,000,000,000 board feet. The northern forest now contains 90,000,000 acres, or 60 per cent of its former area; the southern forest 150,000,000 acres, or 68 per cent; the central forest 130,000,000 acres, or 46 per cent; the Rocky Mountain forest 100,000,000 acres, or 91 per cent; and the Pacific forest 80,000,000 acres, or 89 per cent of its original acreage.

Fire, careless cutting, and excessive grazing have greatly injured the composition and quality of existing forests. No native tree has yet become entirely extinct, but the commercial supply of every kind, except those of the Pacific forest, is seriously reduced.

Forests publicly owned are nearly all in the West. They consist of National Forests, national parks, Indian reservations, military reservations, the forests of the unreserved public domain, and state forests. They contain over 100,000,000 acres of merchantable timber, with a stand of 484,200,000,000 board feet, distributed as follows:

Public forest lands.

		Total stand.
In National Forests	board feet	390, 000, 000, 000
In national parks	do	11, 000, 000, 000
In unreserved public domain	do	14, 000, 000, 000
In Indian reservations	do	34, 000, 000, 000
In military reservations	do	200, 000, 000
In state forests	do	35, 000, 000, 000
Total	do	484, 200, 000, 000

Forestry is practiced on 70 per cent of these public forests.

Forests privately owned fall into two classes—farmers' woodlots and larger private holdings. Woodlots contain 300,000,000,000 board

feet of saw timber and 1,500,000,000 cords of wood. They cover 200,000,000 acres, 95 per cent of which is in the region east of the plains, where woodlots form about one-half the forest. Woodlots consist in the main of scattered patches of original forest, from which the best timber has been cut. They are made to yield little saw timber, but furnish the chief supply of fuel, posts, and rails, and of wood for other domestic and some local uses. Particularly in the East woodlots furnish a considerable number of hewn ties. Through their location among farm lands and their small individual area, woodlots suffer less damage from fire than do large timber tracts. But they are seldom conserved by the regulation of either cutting or grazing.

Corporate holdings with the larger individual holdings contain about 1,700,000,000,000 feet of timber. This is, on the average, the most valuable timber in the United States. Forestry is practiced on much less than 1 per cent of the timber tracts privately owned.

WHAT IS PRODUCED.

The yearly growth of wood in our forests does not average more than 12 cubic feet per acre. This gives a total yearly growth of less than 7,000,000,000 cubic feet.

Nearly all our native commercial trees grow much faster than those of Europe. We already grow post timber in twenty to thirty years, mine timber in twenty-five to thirty-five years, tie timber in thirty-five to forty years, and saw timber in thirty to seventy-five years.

We have 200,000,000 acres of mature forests, in which yearly growth is balanced by decay; 250,000,000 acres partly cut over or burned over, but restocking naturally with enough young growth to produce a merchantable crop; and 100,000,000 acres cut over and burned over, upon which young growth is either wholly lacking or too scanty to make merchantable timber.

That our forests grow very slowly, although the individual trees of many kinds grow fast, is our fault. In Europe forests composed of trees growing much slower than most of ours produce over four times as much because the forests are cared for.

We have twenty important kinds of trees which produce in one hundred years or less timber fit for the saw. In favorable localities, cottonwood, red gum, white ash, and loblolly pine in the South, and redwood, Douglas and other firs, Sitka spruce, and western yellow pine on the Pacific coast, will grow saw timber in thirty to seventy-five years.

Under present conditions, chestnut, cypress, redwood, yellow poplar, red and black oak, loblolly, jack, red and white pine, and western yellow pine will grow post timber, four to eight inches in diameter, in fifteen to thirty years. We are already getting mine props in twenty-five to thirty-five years from red or black oak and loblolly pine, from

white oak in forty-five years, from red pine in forty years, from lodgepole pine in sixty years, from western yellow pine and Douglas fir in the Rocky Mountains in fifty years and on the Pacific coast in thirty-five years.

The time now needed to grow a tie in our forests runs from thirty-five years for red gum to one hundred and fifty years for white cedar and tamarack in the northern swamps. Douglas fir and western yellow pine on the Pacific coast, and chestnut, red oak, and loblolly pine are, on the average, making tie timber in forty to forty-five years, cypress in sixty-five years, longleaf pine in seventy-five years, white oak in eighty years, lodgepole pine in the Rockies, and beech, in one hundred years, and western hemlock in one hundred and thirty years.

These figures are taken from measurements of trees grown in forests not conservatively managed. In the same forests, conservative management would, as the result of greater density, less unsoundness, and the growing of desirable kinds, not only yield several times as much timber in the same period, but would increase the growth of individual trees.

The 200,000,000 acres of mature forest in the United States are mainly in the northern Rockies and on the Pacific coast, the very regions in which the immature forests grow most rapidly. The 250,000,000 acres partly cut or burned over, but restocking naturally with young growth, are mostly in the southern mountains and in the southern pine belt. The 100,000,000 acres cut over and burned over, upon which young growth is wholly lacking or too scanty to make merchantable timber, are chiefly in the Lake States and in the southern pine belt.

WHAT IS USED.

We take from our forests yearly, including waste in logging and in manufacture, 20,000,000,000 cubic feet of wood.

We use in a normal year 90,000,000 cords of firewood, 40,000,000,000 board feet of lumber, 118,000,000 hewn ties, 1,500,000,000 staves, over 133,000,000 sets of heading, nearly 500,000,000 barrel hoops, 3,000,000 cords of native pulp wood, 165,000,000 cubic feet of round mine timbers, and 1,250,000 cords of wood for distillation.

The kind and quality of timber used for these products vary enormously. The great bulk of firewood comes from farmers' woodlots or from forests already logged. Some of it is made from wood unfit for any other use, but a large part is taken from immature trees, especially hardwoods of kinds valuable for lumber.

Lumber and shingles are usually made from large timber of high quality. Lumber is being made in commercial quantities from 30 kinds of trees. Softwoods furnish 77 per cent of our total yearly lumber supply, and hardwoods 23 per cent.

The southern pines furnish over 30 per cent of our lumber; Douglas fir about 12 per cent; white pine, 10 per cent; oak, 9 per cent; and hemlock over 8 per cent.

Washington was first in lumber cut in 1907, furnishing 9.4 per cent; Louisiana was second, with 7.4 per cent; Texas came next, with 5.5 per cent; and Mississippi, Wisconsin, and Arkansas followed closely, with about 5 per cent each.

The center of lumber supply in the United States shifts constantly, as one region is cut over and another is attacked. The changes in the output by States are striking. Michigan supplied 23 per cent of the total lumber output in 1880 and 4.5 per cent in 1907. Washington yielded less than 1 per cent in 1880 and over 9 per cent in 1907.

Over three-fifths of our shingles are made from western red cedar, chiefly in Washington, and the remainder mainly from eastern white cedar, cypress, and redwood. Telephone, telegraph, and electric light and traction companies use each year between three and four million poles in various lengths above 20 feet. Three-fifths of these are white cedar, cut chiefly in the Lake States, and over one-fourth is chestnut. Much cedar and chestnut, as well as many woods common to other regions, are used for smaller sized poles and for posts and fence rails. The oaks, chiefly white oak, furnish over 45 per cent of the hewn railroad ties. The cutting of young oak for ties, next to the cutting of oak logs for lumber, is the most serious drain upon our oak forests. Other kinds much used for ties are the southern and western pines, cedar, chestnut, cypress, and hemlock. Many woods are used for slack cooperage stock, of which the chief are red gum, pine, elm, beech, and maple. A large part of the tight cooperage stock is high-grade white oak, which results in another heavy drain upon the oak forests.

Our paper and pulp mills use over 3,000,000 cords of native wood each year and import more than 900,000 cords from Canada. Nearly three-fifths of the native pulp wood is spruce, cut mostly in the Northeastern States, and one-fifth is hemlock, which comes chiefly from Pennsylvania and Wisconsin.

The cutting of mine timbers takes each year great quantities of immature timber from forests in the mining regions, the kinds used varying with the locality.

Nearly all wood used for distillation is beech, birch, and maple. In relatively few cases this wood is saved from the waste in logging.

WHAT IS WASTED.

Forest fires burn over millions of acres and destroy billions of feet of timber annually. The young growth destroyed by fire is worth far more than the merchantable timber burned.

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One-fourth of the standing timber is left or otherwise lost in logging. The boxing of longleaf pine for turpentine has destroyed one-fifth of the forests worked. The loss in the mill is from one-third to two-thirds of the timber sawed. The loss in the mill product through seasoning and fitting for use is from one-seventh to one-fourth. Great damage is done by insects to forests and forest products. An average of only 320 feet of lumber is used for each 1,000 feet which stood in the forest.

Prodigious waste has accompanied our use of the forest. The chief causes are fire, wasteful methods of logging and turpentining, waste in the mill, and waste in the use of wood.

Forest fires have destroyed many billion feet of commercial timber. They have driven the forest from vast areas, upon which the actual planting of trees will be needed before the forest will return to them. They have destroyed or injured young growth whose value is much more than that of the timber burned. They have changed greatly for the worse the quality and composition of existing forests. To them is due, far more than to the wasteful logging which they have usually followed, the decline in the utility of our streams for all useful purposes; and, through erosion, forest fires are working destructive change in the configuration of the land itself.

The average waste in the woods is 1,000 board feet to every 4,000 board feet logged. This is due to a variety of causes, many of which could be wholly removed with both present and permanent profit, and all of which could be greatly reduced with the same result. Chief among them are plans for logging poorly made or poorly carried out; the leaving of merchantable timber in the woods either actually cut or in dead trees, trees partly unsound, or trees of the less valuable kinds; the waste of timber in high stumps and long tops, and in the failure to cut logs to such lengths that the tree is most profitably used; breakage in felling, loss in lodged trees, and in driving; and the use of good timber for temporary construction in logging, for which inferior timber would serve equally well. But still more serious than all these forms of waste combined, in its effect upon the future timber supply, is the well-nigh universal damage in logging, for the most part wholly unnecessary, to the young growth.

The experience of half a century has clearly shown in Virginia, the Carolinas, and Georgia that turpentining under present methods renders a permanent naval-stores industry in the South utterly impossible. These methods usually render the forest unproductive in four or five years. They have so greatly reduced the longleaf-pine forests available for turpentining that in some localities trees 4 or 5 inches in diameter are now being boxed. This generally means an exceedingly low return in turpentine and the death in a few years of trees, which would otherwise have grown to make lumber.

In the mill logs lose from 30 to in some cases as much as 70 per cent of the volume of timber they contain. Two-thirds of this, under present conditions, is an unavoidable waste. One-third can practically and profitably be avoided. In the manufacture of lumber, which forms over nine-tenths of the total mill product, the merchantable output is about two-thirds the contents of the log, not including the bark. For the entire lumber cut of the United States under present practice the saw kerf forms on the average 13 per cent of the total volume of the log, edgings and trimmings 9 per cent, and slabs 9 per cent. Cutting to standard lengths and widths, carelessness in manufacture, and accidents cause a loss of 5 per cent.

The waste in seasoning, in the factory, and in the use of the final product is far more difficult to estimate closely. In the building trades the waste in seasoning from staining, warping, and checking, and the loss in fitting material to final forms are not less than 15 per cent. The waste in cutting stock to required sizes and in eliminating defects is 20 per cent in box factories and 25 per cent in furniture factories.

In the aggregate great damage is done each year to standing and cut timber by injurious forest insects. Much of this damage can be prevented at small expense. The application, practically without cost, of simple preventive measures against injurious forest insects and insects which attack forest products would greatly reduce the unnecessary losses which they occasion. The protection of the forest from insect depredations, both by preventive measures such as conservative logging and by remedial measures when necessary, is no less a part of practical forestry than is the protection of the forest from fire. The damage by insect attack to timber standing and cut is not so generally apparent nor so generally understood as the damage to the forest by fire. But the injury done is both great and constant. Unless forest owners take vigorous steps against it wherever it threatens still larger losses will inevitably ensue.

Great causes of waste, vast in their effect upon our forests, are the general failure to realize that the cost of growing timber as well as logging and manufacture must be reckoned in its value; and tax laws which force men to realize immediately on their holdings and so lead to unprofitable and wasteful logging, and which compel the abandonment of cut-over lands for taxes.

WHERE WE STAND.

We take from our forests each year, not counting the loss by fire, three times their yearly growth. We take 36 cubic feet per acre for each 12 cubic feet grown; we take 230 cubic feet per capita, while Germany uses 37 cubic feet and France 25 cubic feet.

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We invite by overtaxation the misuse of our forests. We should plant, to protect farms from wind and to make stripped or treeless lands productive, an area larger than that of Pennsylvania, Ohio, and West Virginia combined. But so far, lands successfully planted to trees make a total area smaller than Rhode Island. And year by year, through careless cutting and fires, we lower the capacity of existing forests to produce their like again, or totally destroy them.

The condition of the world supply of timber makes us already dependent upon what we produce. We send out of our country one and one-half times as much timber as we bring in. Except for finishing woods, relatively insignificant in quantity, we must grow our own supply or go without.

By wasteful logging, fire, and general failure to provide for a second crop we have made our forests less productive than any others of similar area in the world, in spite of the remarkably quick growth of most of our timber trees. We have taken our dividends out of our forest capital until we have greatly reduced the capital itself. Our use of wood per capita is larger than that of any other nation. Canada, which has 60 acres of forest per capita to our 6, uses less than 200 cubic feet per capita; Germany uses 37 feet, France 25 feet, and Great Britain 14 feet. We use 230 cubic feet.

We have 65,000,000 acres of cut-over and burned-over forest land, upon which actual planting will be necessary to produce a merchantable crop of timber. Of the 9,500,000 acres of forest cut over each year, 1,000,000 acres is cleared for farms; 5,750,000 acres is restocking naturally with enough young growth to produce a merchantable crop, and 2,750,000 acres go to increase our national task in forest planting. But the entire area already planted successfully in our whole history is less than one-fifth of that upon which we destroy the forest every year.

White pine is so nearly used up that the lumber sawed from it in the Lake States has fallen off 70 per cent since 1890, and since 1900 over 45 per cent in the whole country. We make 16 per cent less oak lumber and 22 per cent less yellow poplar lumber than we did seven years ago. Douglas fir and yellow pine, now our chief source of supply, are going far quicker than they grow, and the yellow pine is going very rapidly. Yellow-pine lumber in 1907 cost 65 per cent more at mill than it did in 1900; Douglas fir cost 63 per cent more; white pine 53 per cent more; oak 54 per cent, yellow poplar 78 per cent, and hemlock 55 per cent more.

We tax our forests under the general property tax, a method of taxation abandoned long ago by every other great nation. In some regions of great importance for timber supply, and in individual cases in all regions, the taxation of forest lands has been excessive and has led to waste by forcing the destructive logging of mature forests, as well as through the abandonment of cut-over lands for taxes. That this has not been even more general is due to under-

assessment, to lax administration of the law, but to no virtue in the law itself. Already taxes upon forest lands are being increased by the strict enforcement of the tax laws. Even where this has not yet been done, the fear that it will be done is a bar to the practice of forestry.

The protection of all public forests from fire is not yet achieved, and an average of 1 acre in every 10 of forest privately owned is burned over yearly. Many of these fires destroy little or no old growth, but wherever fire runs in our forests it either reduces or destroys their capacity to produce again.

We send wood out of the country and we bring it in. But for each billion feet brought in we send out 1,500,000,000 feet, and the total difference goes to increase by nearly 1 per cent the yearly drain upon our forests. No other country is or will be in a position to meet our needs. Europe imports more wood than she exports. Africa imports structural timber, and can export only expensive hardwoods. The same is true of India, the chief forest country of Asia. China imports wood, and will require any surplus furnished by Siberia and Manchuria. Japan should finally supply her own needs. The Philippines now import much timber, but should eventually grow it, with some surplus for export to China. The total stand of merchantable timber in the Philippines is about equal to the lumber cut in the United States for two years. Alaska has probably as much as the Philippines. Hawaii can export only hardwoods in small quantities. Mexico and Central and South America import structural timber and export mahogany and cedar. South America has great forests which when utilized and cared for should supply the home market. We get about 900,000,000 feet of lumber and 900,000 cords of pulp wood from Canada each year, or 2 per cent of the lumber and 23 per cent of the pulp wood which we use. Canada has more spruce pulp wood than we have, but her standing saw timber is only about one-third of ours. Canada will eventually require all the lumber which her forests can grow.

Whether we take care of our forests, or whether we do not, we can expect (save for a trifling quantity of finishing woods) to use what timber they grow, and no more.

The records prove that, other factors remaining constant, industrial progress is accompanied by increased consumption of wood. This fact is so universally manifest that it can not be thought an accident. It may be regarded as a law of industrial life.

It might be supposed that the substitution of other materials for wood, which takes place with industrial progress, would decrease the per capita need of wood, but such is not the fact. Substitutions may diminish consumption for specific purposes, but this is more than

made up for by the development of needs for wood along new lines or of greater needs along old lines. Only rising prices can serve to lessen the consumption of wood by an advancing nation, and after wasteful use has been cut off, any further reduction means an economic disadvantage. It means harder conditions of life, a handicap on industry.

In the United States our use of wood is lavish. By better methods in the woods, at the mill, and in ways of use we can make what we have go further than we are now making it go, without industrial hardship. On the other hand, our legitimate need will certainly not decline but advance as we go on to greater industrial strength. We can without hardship reduce our per capita consumption through economies; but after we have reached a reasonable basis we must expect to see our needs advancing again. We are like a growing family which is extravagantly living beyond its income, but which is sure to need, when it has cut off extravagant use, an advancing income through future years.

WHAT SHOULD BE DONE.

We should stop forest fires. By careful logging we should both reduce waste and leave cut-over lands productive. We should make the timber logged go further by preservative treatment and by avoiding needless loss in the woods, the mill, the factory, and in use. We should plant up those lands now treeless which will be most useful under forest. We should so adjust taxation that cut-over lands can be held for a second crop. We should recognize that it costs to grow timber as well as to log and saw it.

We should continue and perfect, by State and nation, the preservation by use of forests already publicly owned; and we should extend it to other mountain forests more valuable for the permanent benefit of the many than for the temporary profit of a few.

For each million acres of forest in public ownership over 4,000,000 are privately owned. The conservation of public forests is the smaller task before the nation and the States. The larger task is to induce private forest owners, which means 3,000,000 men, to take care of what they have, and to teach wood users, which means everyone, how not to waste.

If these things are done, they will conserve our streams as well as our forests. If they are not done, the usefulness of our streams will decrease no less than the usefulness of our forests.

THE DUTY OF THE PRIVATE OWNER.

Four-fifths of our standing timber is in private hands. The conservation of our forests and of the timber used depends mainly upon individual forest owners and users. If American citizens will protect their forests from fire, will provide by conservative logging for a good second crop, and will take every reasonable precaution against the waste of timber in the woods, in the mill, in the factory, and in use, their forests will eventually supply more than their need, continu-

ously. If these things, each one of which will pay now and in the future as well, are not done, this nation will ultimately be dependent upon public forests. These, if cut absolutely clean, would furnish only enough lumber to meet our national need for ten years. At the end of that time they would be exhausted. If we are to be saved from great suffering for lack of timber, the forests of private owners must supply the timber.

STOPPING FOREST FIRES.

Forest fires are preventable at a cost slight in itself and insignificant compared with the value of the timber they destroy. Experience on the National Forests has shown that the way to keep down fires is to employ men to watch for them during the fire season. An expenditure of a few hundred dollars in employing men to patrol during the dangerous part of the year is vastly more effective than the expenditure of many times this sum in the attempt, often futile, to put out fires already under headway.

The cost per acre of protecting the forest from fire varies directly with the density of settlement, with local sentiment, with the character of the country and of the forest, with the means of transportation and communication, and with the length of the fire season.

Studies made by the Department of Agriculture and the experience of private owners who are protecting their forests from fire show that the forests of the southern mountains and of the southern pine belt can be effectively patrolled for 2 cents per acre per year. The northern forests can be patrolled thoroughly for not more than 4 cents per acre, and the Rocky Mountains and Pacific coast forests for 1½ cents per acre. These estimates mean, if their owners would cooperate effectively, that all forests in private hands in the United States can be protected from fire for less than $10,000,000 a year—about the cost of one *Dreadnought*. It also means that at an expenditure of $10,000,000 a year, a yearly loss in merchantable timber much greater would be prevented. This does not count the saving in young growth.

The best methods of fire protection for private owners vary greatly with the conditions which fix its cost. But for all regions the following principles are sound on tracts of some size:

1. Employ an adequate force whose first duty is to patrol against fires. Give them all the tools they need, and mount them if they can so work more effectively. In the South and in the Rocky Mountains a mounted patrol is best. In many parts of the northern and Pacific forests, men can do their best work on foot.

2. Increase the efficiency of the fire-fighting force and reduce its size by building trails for patrol. Telephone lines can be built

cheaply and if properly distributed throughout the forest, and combined with a good trail system, will increase several times the area which can be effectually patrolled by one man.

3. Build up a local sentiment against fires by making the damage they do plain to all.

4. Cooperate in fire patrol with other forest owners. Above all cooperate with those who own tracts contiguous to your own. This will render your patrol and theirs not only cheaper but vastly more effective.

FOREST PLANTING.

Forest planting means the protection of denuded watersheds from erosion, and the protection of farm homes and crops from wind and cold. In many localities it means the production of timber near by instead of bringing it from a distance at much greater cost.

The United States contains 65,000,000 acres of stripped land, suitable only for the growing of trees, which will not bear a productive forest again except through the actual planting of trees, or sowing of tree seeds. The West contains 16,000,000 acres of naturally treeless land which should be planted to trees in the interest of agriculture in the prairie region and on irrigated lands elsewhere. Thus far, we have planted in all less than 1,000,000 acres, of which probably less than one-half is successful, because we have planted, for the most part, without adequate knowledge of where, what, and how to plant.

As regards the need for tree planting, the United States naturally falls into three regions—the eastern, the central, and the western.

The eastern region lies east of the prairie States. In it the planting of trees for the production of timber is of much more importance than for protection to stream flow or to crops. It contains lands of the following classes, which can be planted with profit to their owners:

Cut-over lands not good to farm, upon which, usually as a result of repeated fires after logging, natural reproduction is not taking place. Lands suitable only for forest, but which have been cleared, farmed unsuccessfully, and then abandoned. Wood lots in which planting is necessary to supplement natural reproduction or to take its place.

Cut-over and burned-over lands in need of planting aggregate 3,500,000 acres, and occur mainly in the Adirondack region and in the northern portion of the lake States; abandoned farm lands occur mainly in New England and in the southern mountains; unproductive wood lots are characteristic chiefly of the region west of the Appalachians and east of the prairies.

The Southern States contain about 12,000,000 acres upon which natural reproduction is insufficient or lacking, but upon which ade-

quate fire protection will in the main restore good forest conditions. In the eastern region about 92,000 acres have been planted, of which 5,000 acres are state forest lands.

The central region comprises the prairie country, which includes Illinois, Iowa, North Dakota, South Dakota, Nebraska, and Kansas, the prairie district of Minnesota, and those parts of Oklahoma and Texas which lie west of the hardwood belt. It contains about 14,000,000 acres, which should be planted to trees for the protection of crops from wind, to reduce evaporation, and to grow timber for farm and other local uses. Planting already covers 831,000 acres in this region, and wherever rightly done yields remarkably high profit.

The western region includes the Rocky Mountain and Pacific coast States. In it the planting problem is mainly federal. Not less than 5,000,000 acres or about 3 per cent of the area of the National Forests must be planted to protect watersheds and to increase the production of timber. Southern California alone contains probably not less than 1,000,000 acres outside National Forests which are now unproductive and could be made productive under trees. Planting is necessary upon nearly 3,000,000 acres to protect crops on irrigated lands in the western region. Private owners have planted only 37,000 acres of such lands thus far. On National Forests experimental planting and sowing has been done upon 1,762 acres. This has been carefully planned and carried out, and already furnishes the knowledge required for successfully planting on a large scale as soon as the necessary funds are available.

To sum up, our task in forest planting is vast. Thus far in actual acreage successfully planted our accomplishment is wholly inadequate. The area of naturally treeless lands already planted is utterly insignificant in comparison with their total extent. Upon denuded forest lands we have planted only 1 acre to each 10,000 we have to plant.

RECOGNIZING THE VALUE OF TIMBER.

We have manufactured more lumber and other forest products than we require. That is, we have established a consumption per capita, based not merely on actual need, but on a lavishness, a disregard for possible substitutes, and a scale of waste in the use of wood equaled in no other country. Supply has been regulated to a demand swollen not so much by industrial development, great as it has been, as by a product unduly cheap, because the items of logging and manufacture were considered the main costs of producing it. The cost of growing the trees has always been left out.

That there is, in the economic sense, overproduction of lumber is wholly true, because we manufacture more lumber than our forests

can yield permanently. No economic reason fully explains the difference between the price of lumber grown in the United States and of lumber grown in Europe. Difference in the density of population explains it only in part. But neither that nor the relation of supply to demand is the chief cause. It lies in our failure to realize that if we are to grow timber continuously to meet our needs its value must be reckoned by the cost of growing it as well as by the cost of logging and manufacture. Stumpage prices in the United States average less than one-fifth of the price of lumber at the mill. The value of anything which is needed is at least what it will cost to grow it again.

We pay generally less for lumber than it is worth, with a slight present gain to ourselves individually, and by so doing we discourage the right use of the forest and greatly increase the cost of lumber to ourselves later on, and to those who come after us. We must recognize the actual value of timber now or pay an excessive price for it in the future, and we have carried destruction so far that we shall probably have to do both.

CONSERVATIVE TURPENTINING.

An important source of waste is boxing small trees, which yield little turpentine and soon die. If left standing, these small trees would make lumber and pay well. Another source of waste is boxing larger trees so deeply that they die in a few years or are blown down, while in the meantime the deep wound made in boxing invites fire. Improved methods of turpentining yield 30 per cent more turpentine and better turpentine, do not invite windfall, and lessen injury from fire. Under these systems, combined with other economies possible, a forest can probably be worked for fifteen to twenty years, and made to yield much more turpentine, with small injury to the merchantable timber.

If improved methods of turpentining are given general use in longleaf pine forests and in the working of other southern and western pines, they will mean both a permanent naval-stores industry, a higher profit to turpentiners, and an important gain in the continuous timber yield of our forests.

CONSERVATIVE LOGGING.

Through careless and destructive logging on private forest lands, an average of 25 per cent of the merchantable timber is left standing, or otherwise wasted in the woods. On National Forests, from which has been sold yearly for the last three years an average of about 250,000,000 board feet of timber, the total waste in logging is about 10 per cent. This timber was sold at prices no lower than those paid

for timber of the same kind and quality on private forest lands. It was logged and manufactured by the lumbermen who bought it, and sold by them in the open market, in competition with lumber cut from private forest lands under wasteful methods. In 1907 the Federal Government was asked by lumbermen to sell at good prices, from National Forests, several times as much timber as it sold. That it did not make more timber sales was partly because the force on National Forests was not large enough to handle them. But if lumbermen can, with profit, buy timber at what it is worth from the forest lands of the people, and log it conservatively, they can do at least as well with their own.

Part of the waste in logging is unavoidable under present conditions. The following discussion deals specifically with those items of waste which it is practicable to avoid now, often with higher immediate profit to the owner of the land from which the timber is cut, and always with higher permanent profit from the land itself after it is cut over the first time.

Care for young growth.—The loss to the value of the forest, through injury to young growth in logging, is larger than the waste of merchantable timber. A small part of this damage is unavoidable. Nearly all of it is avoidable without materially increasing the cost of logging. It costs no more money to fell a tree uphill than to damage young growth by felling it downhill. It does not cost much to release young trees bent over by the tops of felled trees. More logging roads, skidding paths, and snake trails than are really needed kill much young growth, and they do not make for cheap logging. Rolling logs down hill is seldom necessary, and it often breaks down young trees which are worth more than the log is worth to the lumberman who means to hold his cut-over land or to the men to whom he sells it. Young trees are worth at least as much as it costs to replace them, or about $10 an acre; and $10 an acre spent in forest planting will seldom give us as good a forest as nature will grow for us, if we will take care of the young growth.

Leaving seed trees.—How many and what seed trees to leave, and where, depends on the cost of logging, on the character of the forest, and on the power of its most valuable trees to reproduce themselves. There are no general rules which apply to all forests. It is seldom necessary to leave prime timber as trees for seed. Unsound trees which will probably live long enough to seed up the area, scrubby trees already bearing seed, but unfit for lumber, and thrifty trees too small to be logged with the highest profit now, generally serve the purpose well.

The lumberman who claims that it does not pay to leave seed trees to shed seed, or to take care of young trees, because we may not live

to harvest them, forgets these things: That second growth grows much faster than first growth, and that cut-over lands suitable only for forest purposes, which bear young growth, already have a good market value, while cut-over lands bearing neither timber nor young growth have little or no value.

Saving immature trees.—Poor grades of lumber come chiefly from small trees. As the tree gets larger the proportion of choice grades increases. A good many lumbermen are now cutting small trees at a profit, which, figured against what they would make from the same trees in ten or twenty years, means not profit, but loss. Some lumbermen are cutting small trees at a direct loss. There is no more fruitful investigation for any lumberman than to figure from the cut of his own mill the volume and grades of lumber sawed from trees of different sizes.

The full use of standing timber.—The failure to cut fire-killed or otherwise damaged timber, to log inferior kinds along with the most valuable kinds, and the leaving of isolated patches which are hard to reach means an average loss to the owner of 1,000,000 to every 10,000,000 feet logged and often much more. It also means much greater danger from fire and insects and a second growth poor in kind and quality.

Clean work in the woods.—Waste in the woods comes in part from leaving trees, which, though partly unsound or otherwise defective, are still merchantable. It comes in part from high stumps, from trees broken in falling and from lodged trees, from leaving timber in the tops, and from failure to cut logs into lengths so as to provide for the fullest possible use of each tree. It comes in part from leaving in the woods skid poles, ties, camp logs, and other timber used in temporary construction, instead of saving it for pulp, for lumber, or for use again. Especially after deep snow scattered logs are often left lying in the woods, or even piled on the rollways. In the construction of logging roads and temporary building much waste occurs in the unnecessary use of timber of valuable kinds.

There are very few lumbermen in the United States who are not guilty of this waste in one or more forms. The remedy requires no detailed plan. It calls for thorough supervision, for the habit of thrift on the part of the operator, and the enforcement of thrift among his men. A logger who wastes timber in the woods for his employer should be sent out from them just as quickly as a wasteful edgerman or grader is sent out of the mill.

Economy in transportation.—In railroad logging unnecessary loss occurs in the failure to pick up logs fallen from cars or scattered by wrecks.

An average of probably 5 per cent of the timber put into streams for driving is lost. On long drives and rough streams a small part of this damage is unavoidable. But it can probably be reduced on the average by more than half by peeling and drying out logs of kinds which do not float well, by stream improvements, and by reasonable care on the drive itself.

ECONOMY IN THE MILL.

An average of more than one-third of the wood in the log is wasted in the mill. It is practicable, under present conditions, to reduce this nearly one-half. This means the use of thinner saws, or more band saws and resaws, and the disuse of gang saws. It means better machinery, more careful manufacture, and the sawing in round edge or "waney" form of lumber which is worked over again before being finally used. It means the change of grading rules and market usage to admit random widths, odd lengths, and shorter and narrower pieces, and to allow defects which do not seriously reduce the value of the product for the use to which it is to be put, and it means fuller utilization of short boards, slabs, and waste.

MANUFACTURE OF BY-PRODUCTS.

Even when forest products are manufactured and used economically great opportunity remains for the conversion of wood not utilized in logging or in the mill into useful by-products by chemical and other means. As timber becomes more valuable we approach more nearly that complete utilization in which every part of the felled trees will be used.

If all the wood wasted in the manufacture of yellow-pine lumber in 1907 had been steam distilled for the production of wood turpentine, it would have yielded more than the total production of gum turpentine in that year. If all the wood wasted in the manufacture of lumber from spruce, hemlock, poplar, and cottonwood in 1907 had been used for paper making, it would have furnished all the paper made from wood in that year. If all the wood which went to waste in the manufacture of chestnut lumber in 1907 had been used to make tanning extract, we would have produced twice as much as was produced from the chestnut cord wood used for this purpose. The waste in the manufacture of beech, birch, and maple lumber in 1907 was nearly equal to the quantity of these woods cut for distillation. The waste in the manufacture of oak lumber was twice the quantity of all hardwoods used for distillation. These are some of the great examples of the failure to use wood fully.

PRESERVATIVE TREATMENT OF TIMBER.

Of all the wood in every form now in use in the United States, decay, fire, insects, and salt-water borers destroy not less than the equivalent of 8,000,000,000 board feet each year. Of these, decay is far the most destructive. It is also the easiest to retard. The preservative treatment of timber will lengthen by ten to twenty years the life of woods now commonly used for posts, poles, ties, mine timbers, bridge timbers, and for much other construction work. It will also make profitable the use of many woods which untreated, decay so quickly that they have little or no value. If preservative treatment makes the life of timber in use twice or three times that of untreated timber, only one-half or one-third as much timber is consumed by that use. Nor does this take into account that large saving in the labor of replacing decayed timber, which in the maintenance of railroad tracks, using untreated ties, is about one-third the cost of the new ties used each year, to keep the track in condition.

In 1907, 1,250,000,000 board feet of timber were treated, which was not more than one-quarter the quantity which could have been treated with profit to its users. There are about 700,000,000 ties in railroad tracks in the United States. They represent, untreated, an average cost per tie of about 12 cents a year. If all were treated, the increase in their length of service would mean a saving of 2.3 cents per tie per year, or a total annual saving of about $16,000,000. More than $2,000,000 could be saved each year by treating all the poles, and nearly $2,000,000 if all the piling were treated. The saving in timber used in the mines would be about $12,000,000. If lumber so exposed in use that treatment is profitable were treated, the saving would not be less than $15,000,000. This means a total practicable saving of over $47,000,000 a year. It means also that the increased life given these timbers would make an annual saving in wood equivalent to 4,000,000,000 board feet, or 10 per cent of the yearly lumber cut.

Two preservatives are widely used in the United States. These are creosote and zinc chlorid. The chief advantage of creosote is that once injected into wood it prevents decay permanently. Its chief disadvantages are its cost and scarcity. Zinc chlorid is cheaper and an excellent antiseptic. But it will leach out if the treated wood is exposed to moisture.

A farmer can treat a fence post with creosote for about 10 cents and make it last twenty years. Apparatus costing from $50 to $75 will treat from 50 to 100 posts a day, depending upon the kind of timber. The butt of a 20-foot telephone pole can be treated for from 75 cents to $1. The plant will cost from a few hundred to several thousand dollars, depending upon its capacity. Piling properly

treated with creosote is not attacked by salt-water borers. Mine timber can be treated with zinc chlorid for from $4 to $5 per thousand board feet. Ties can be thoroughly treated with zinc chlorid for 10 to 12 cents and creosoted for 20 to 30 cents.

USE OF SUBSTITUTES.

Seasoning and factory wastes can be reduced somewhat by improved methods of drying and manufacturing. But a larger part of the necessary saving in the use of timber must come through the substitution of other materials. Stone, brick, steel, and concrete are now less expensive building materials than wood, when depreciation and fire risks are taken into account. Steel is rapidly supplanting lumber in car construction, and concrete, steel, and masonry are taking its place in bridges. Savings possible in building and railway construction alone, if carried to the limit, would diminish by at least one-third the present consumption of lumber. In the furniture industry it is estimated that approximately 50 per cent of the beds now manufactured are made of metal. The use of pressed steel for desks, file cases, and other office furniture is becoming more and more common. To a small extent, as yet, steel is replacing wood for wagon axles, rims, hubs, and spokes, and in the form of thin plates is being used for paneling in wagon bodies.

BETTER TAX LAWS.

From now on the relation of taxation to the permanent usefulness of the forest will be vital.

Taxation of forest lands should be based either on the yield when cut or on the earning power of the forest. The former would mean a tax on the land alone, plus a tax on the timber when harvested; the latter would mean an annual tax on the capital value of the forest calculated upon the net returns expected from it. The tax on the timber when cut and an annual tax upon the land itself, exclusive of the timber, has practical advantages. It does not involve forecast of the rate of interest, of the risk of loss by fire, or of timber values, nor does it require exact statistics of the growth of timber.

A tax on the timber when cut and an annual tax upon the land itself, exclusive of the timber, is well adapted to the actual conditions of forest investment, and is practicable and certain. It would insure a permanent revenue from the forest in the aggregate far greater than is now collected, and yet be less burdensome upon the State and upon the owner. It is better from every side that forest land should yield a moderate tax permanently than that it should yield an excessive revenue temporarily, and then cease to yield at all.

BETTER FIRE LAWS.

Forest fire laws are ineffective mainly because they are not enforced. The purpose of forest fire laws is to prevent fires. That principle should obtain in enforcing as well as in drafting them. A fire law inflicting reasonable penalties which is enforced is much more effective than a fire law inflicting excessive penalties which is loosely applied or waived.

Each State within whose boundaries forest fires are working grave injury, and that means every forest State, to keep down fires, needs not merely a law upon the statute books, but an effective force of men actually on the ground to patrol against fire. The man who prevents the most fires is the man who is looking for them, not the man who goes to a fire after it is under way. The system of voluntary fire wardens is good as far as it goes; but to make it really effective it must be combined with a force of trained men whose first duty is fire patrol and who are sufficiently paid for their work.

EDUCATION.

The right use by American citizens of the forest and of timber will not be general until they learn how to practice forestry. For years the Department of Agriculture, by spreading broadcast the facts gained in its forest studies and by actual cooperation with the individual in the handling of his timber tract, his woodlot, his forest plantation, and his timber-treating plant, has aimed to awaken the American people to their national and individual need for forest conservation.

Forestry has been given root and being in the great body of American citizenship. No country takes poorer care of its private forests than ours, and no nation has a more wholesome and enthusiastic public sentiment for the right use of the forest than our own.

WHERE WE MIGHT STAND.

By reasonable thrift we can produce a constant timber supply beyond our present need, and with it conserve the usefulness of our streams for irrigation, water supply, navigation, and power.

Under right management our forests will yield over four times as much as now. We can reduce waste in the woods and in the mill at least one-third, with present as well as future profit. We can perpetuate the naval-stores industry. Preservative treatment will reduce by one-fifth the quantity of timber used in the water or in the ground. We can practically stop forest fires at a total yearly cost of one-fifth the value of the standing timber burned each year.

We shall suffer for timber to meet our needs until our forests have had time to grow again. But if we act vigorously and at once we shall escape permanent timber scarcity.

We take out of our forests each year three times as much wood as they grow, partly because we waste more wood than any other nation. The saving of wood practicable in logging, in the mill, and in use has already been pointed out, but we fail to produce each year much more than the wood we need because we misuse the forest.

Against an average yearly growth of 12 cubic feet per acre in the United States, the forests in Germany, all of which are rightly handled, yield each year 48 cubic feet per acre, and their most common trees do not grow naturally as fast as ours. It is certain that the average annual yield of forests in this country can be made, through protection from fire and through conservative logging, much larger than that of forests in Germany.

Every owner of forest lands can stop fires and log conservatively, with immediate profit, as well as with permanent profit.

Most other countries have already learned that the forests which are not conserved will be used up, and they are taking care of what they have. We are among the last to learn it. We can profit by that knowledge if we will.

Approved:

JAMES WILSON, *Secretary.*

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